

**MECHANICAL ENGINEERING IN ANCIENT EGYPT, PART 96:
INSCRIPTION OF TOMB CEILING DURING THE NEW KINGDOM**

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ABSTRACT

The objective of this paper is to investigate the development of mechanical engineering in ancient Egypt through the study of the inscription of the ceilings in the tombs of the 18th, 19th and 20th Dynasties of the New Kingdom. The study presents wonderful pattern design used in ceiling decoration of both no-Royal and Royal state officials. The decoration patterns are investigated through extracting the main elements in each pattern. Foreground and background colors

are identified in all the pattern designs.

KEYWORDS: Mechanical engineering history, ancient Egypt, tomb ceiling inscription, 18th, 19th and 20th Dynasties, ceiling decoration, pattern design.

INTRODUCTION

This is the 96th part in a series aiming at investigating the mechanical engineering technology in ancient Egypt. It investigates the fantastic and amazing inscription of the Royal and non-Royal tomb ceilings during the 18th and 19th Dynasties.

Bull, 1923 in his paper about ancient Egyptian astronomical ceiling decoration presented the astronomical ceiling decoration in the Sepulehral Hall of Pharaoh Seti I tomb of the 19th Dynasty. He presented also a number of scenes in studying symbols and star names in the 'Great Bear' constellation.^[1] Davies, 1936 in her book ancient Egypt paintings studied the Senenmut presented an illustration diagram for the ceiling showing the most relevant areas of

the celestial diagram including four areas. They presented some scenes; one of them with hieroglyphic text may be for the stars and planets names. They presented also the stellar charts in the tomb of Ramses IX.^[3]

Brown, 2008 in his article about flint and the Northern sky showed that the link between the Northern sky and flint is not arbitrary and there is an analogical correspondence between them. She presented a description of what is called 'Mshtyw' in the tomb of Ramses VI.^[4] Kroenke, 2013 in his paper about the motif alignment project directed by Richard Wilkinson between 1993 and 2003 presented the ceiling scene in the tomb of Pharaoh Seti I of the 19th Dynasty. He zoomed one of the astronomical views in the ceiling with its elements named using the hieroglyphic script.^[5] Nigm Eddin, 2016 in his paper about type of ceiling and its decoration at ancient Egyptian architecture presented a number of ceiling-patterns with blue sky and golden stars. He stated that sky goddess was used to decorate the ceiling of the burial chamber of the tombs of Seti I and Ramses VI and the corridors leading to it. He presented also some rosettes motif from the tomb of Sennefer from the 18th Dynasty.^[6] Priskin, 2019 in his paper about constellations of the Egyptian astronomical diagrams presented the Southern and Northern panels of Senenmut's diagram from the 19th Dynasty. He presented also constellations from Senenmut, Ramses VI, and Seti I tombs,^[7] Hassaan, 2020 published a series of papers aiming at the investigation of the art of tombs inscription during the Old Kingdom,^[8] 11th and 12th Dynasties of the Middle Kingdom,^[9] the 18th Dynasty.^[10] and the 19th and 20th Dynasties of the New Kingdom.^[11] He presented illustrating examples on the inscription techniques used either for painted scenes or carved reliefs with statistical analysis of some of the presented research work.

Inscription of the 18th Dynasty Tombs Ceiling

The 18th Dynasty was the first Dynasty of the New Kingdom, covered a time span from 1549 to 1292 BC and ruled by 15 Pharaohs.^[12] The 18th Dynasty tombs comprised distinguished examples of tomb-ceiling inscription for the purpose of tomb decoration. The idea of tomb-ceiling inscription during the 18th Dynasty is explored through twelve examples as follows:

- The first example is ceiling scene in the tomb of Tetiky, Mayor of Thebes during the reign of Ahmose I, the founder Pharaoh of the 18th Dynasty, 1549-1514 BC in display in the Metropolitan Museum of Art at New York and shown in Fig.1^[13]. The decoration pattern consists of interchanging squares in light blue, white and light brown colors. Inside each square there is a four-petals flower one in yellow, the second and third are in dark red.

Another pattern separated by thin white band is composed of adjacent rhombuses with four-petal small flower inside them and in all the resulting triangles around the rhombuses. The third pattern is a simulation of a wood pulp cut longitudinally with knots. Then, the three patterns are repeated inversely.



Fig. 1: Ceiling scene in the tomb of Tetiky from the 18th Dynasty^[13]

- The second example is a scene for a ceiling pattern from the tomb of Qenamun, Overseer of the Cattle of Amun and Chief Steward during the reign of Pharaoh Thutmose III of the 18th Dynasty, 1479-1425 BC in display in the Metropolitan Museum of Art and shown in Fig.2.^[14] The pattern consists of a white zigzag in the top end bounded by white bands of different thickness and a white spiral surrounded by chain and triangular bands. In between, comes flowers with complete constituents. This is a wonderful scientific scene where the designer showed for each flower the petal, pedicel, sepal and ovary. Each flower was surrounded by a brown ring border ending with a semi-rhombus holding a smaller two colors rhombus. Another white ring surrounded the brown one starting at the flower sepal as a pedicel and ending at another flower. The pattern design needs more effort from plants scientists to explain and analyze.



Fig. 2: Scene of a ceiling pattern from the tomb of Qenamun.^[14]

- The third example is the Southern part of the astronomical ceiling from the tomb of Senenmut, Architect and Government Official during the reign of Pharaoh Hatshepsut, 5th Pharaoh of the 18th Dynasty, 1479-1458 BC shown in Fig.3.^[15] Novakovic considered Senenmut as an astronomer and gave explanation for this part of his tomb-ceiling. I will borrow his words since astronomy is far away from my specialization. He outlined that the southern part of Senenmut's tomb ceiling presented a list of decanal stars, constellations of the southern sky like Orion and Canis Major. The decoration of this part of the ceiling showed also the planets Jupiter, Saturn, Mercury and Venus, and marked the hours of the night.^[16]

- The fourth example is a colored scene in the ceiling of the tomb of Thutmose III, 6th Pharaoh of the 18th Dynasty 1479-1425 BC shown in Fig.4.^[17] The scene simulates the sky with blue color and stars in yellow color arranged in parallel rows. The wall-band under the ceiling is covered by colored column-simulators to look as if they are carrying the ceiling.

- The fifth example is a colored scene in the ceiling of the burial chamber of Sennefer, Mayor of Thebes during the reign of Amenhotep II, 7th Pharaoh of the 18th Dynasty, 1425-1398 BC shown in Fig.5.^[18] The decoration design of the ceiling depends on flower-elements similar to that in Fig.1 except they are housed inside rhombuses instead of squares. Around the rhombuses there are brown-colored zigzags from both sides parallel to the sides of the rhombuses. The set of flowers in one row have brown color while the next row-flowers have black petals. Semi-circular small objects are drawn between the petals.

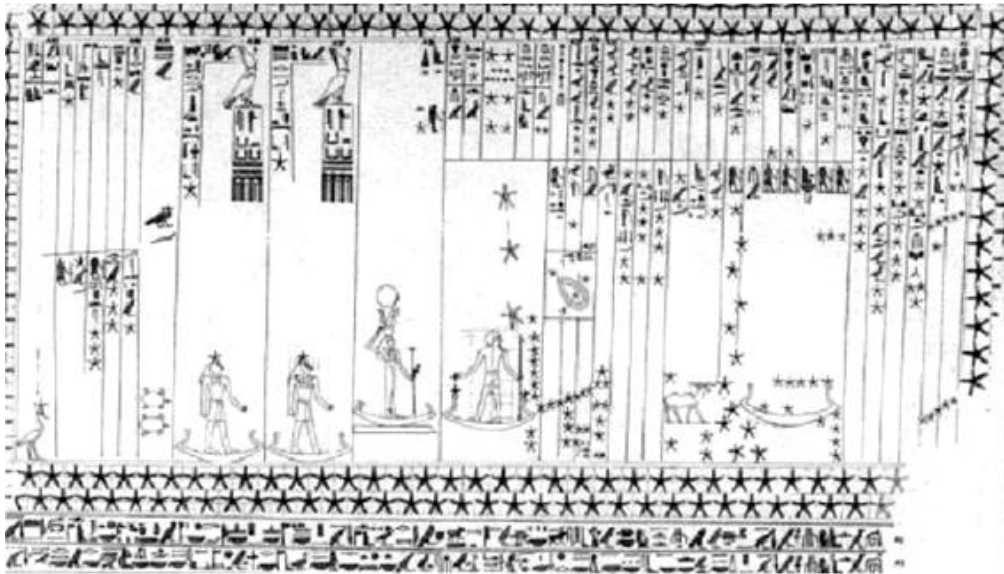


Fig. 3: Southern part of the astronomical ceiling of Senenmut's tomb.^[15]



Fig. 4: Ceiling scan in the tomb of Thutmose III.^[17]

- The sixth example is a colored scene in the ceiling of the tomb of Amenhotep II, 7th Pharaoh of the 18th Dynasty, 1425-1398 BC shown in Fig.6.^[19] The decoration design of the ceiling is similar to that of Pharaoh Thutmose III shown in Fig.6 which is based entirely on stars arranged in parallel lines and covering the whole surface of the ceiling.



Fig. 5: Ceiling scan in the tomb of Sennefer.^[18]



Fig. 6: Ceiling scan in the tomb of Amenhotep II.^[19]

- The seventh example is a scene decorating the ceiling of the tomb of Djutmose, Head of the Secrets in the Chest of Anubis during the reign of Thutmose IV and Amenhotep III, 8th and 9th Pharaohs of the 18th Dynasty, 1398-1350 BC shown in Fig.7^[20]. The decoration pattern consists of set of flower simulators having four blue petals, yellow central style, several anthers and light green flanks around each flower in a distinct design of this flower simulator. There is gap between any flower and the adjacent one arranged on parallel centrelines. The next group on the next centreline are arranged with half period shift with the above group and so on. Between every two flower simulators the designer set a smaller four-petal flower.

- The eighth example is a scene decorating the ceiling of the tomb of Djutmose, Head of the Secrets in the Chest of Anubis during the reign of Thutmose IV and Amenhotep III, 8th and 9th Pharaohs of the 18th Dynasty, 1398-1350 BC shown in Fig.8^[21]. The decoration comprises a four-petal flower simulator inside a rhombus. The rhombuses are touching each other at the longitudinal point edge. A zigzag band is surrounding the rhombuses from their

both ends. Blue, brown, yellow and white pigments were used in producing the decoration pattern of Fig.8.



Fig. 7: Ceiling scan in the tomb of Djutmose.^[20]



Fig. 8: Ceiling scan in the tomb of Nakht.^[21]

- The ninth example is eight scenes decorating the ceiling of the tomb of Nebamun, Scribe and Astronomer during the reign of Thutmose IV, 8th Pharaoh of the 18th Dynasty, 1398-1388 BC in display in the Metropolitan Museum of Art at New York and shown in Fig.9.^[22] The decoration patterns are brand new except number 6 which is similar to the decoration pattern in the ceiling of Djutmose (Fig.7) and number 7 which is similar to the decoration pattern in the ceiling of Sennefer (Fig.5). However, those of Nebamun have outstanding painting quality giving an explanation of why the tomb decorations of Nebamun were copied and transferred to the British and Metropolitan Museums.

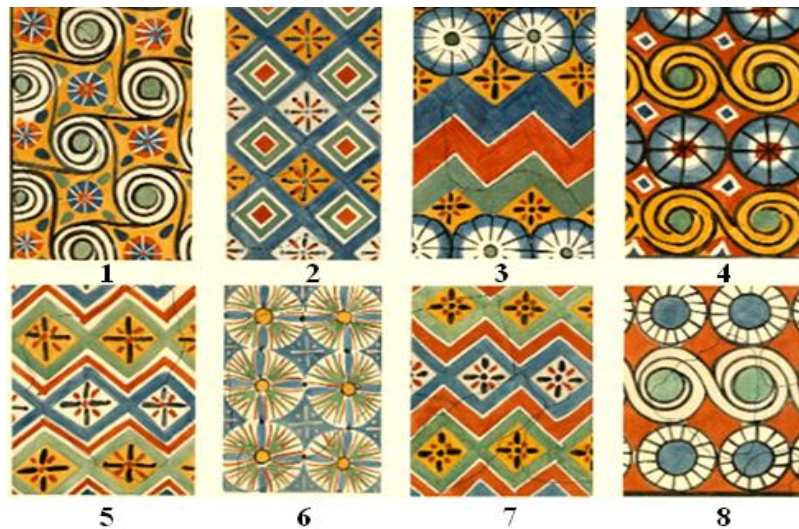


Fig.9: Ceiling scans in the tomb of Nebamun [22]

- The tenth example is a scene decorating the ceiling of the tomb of Amenemhat, Chief Steward and Overseer of the Cattle of Amun during the reign of Amenhotep III, 9th Pharaoh of the 18th Dynasty, 1388-1350 BC in display in the Metropolitan Museum of Art at New York and shown in Fig.10.^[23] This decoration pattern is brand new based on two designs of flower simulators, one giant with four petals and one small with 10 petals housed by the petals of the giant one. In the bottom a band with black and blue colors housing concentric rhombuses of brown and yellow colors.



Fig.10: Ceiling scan in the tomb of Amenemhat [23]

- The eleventh example is a scene decorating the ceiling of the tomb of Roy, Royal Scribe during the reign of Horemheb, 15th Pharaoh of the 18th Dynasty, 1319-1292 BC shown in Fig.11.^[24] This decoration pattern is similar to that of Sennefer tomb in Fig.5 except the

frame around the flower which is a square here while it was a rhombus in Sennefer's ceiling pattern and there is no zigzags here about the flower simulators. In the present pattern design there is a hieroglyphic text painted within a 3-lines band.



Fig. 11: Ceiling scan in the tomb of Roy.^[24]

- The twelfth example is a scene decorating the ceiling of the tomb of Neferhotep, Religious Official during the reign of Pharaoh Horemheb, 1319-1292 BC shown in Fig.11.^[25] This decoration pattern has a brand new design consisting of decoration segments each one comprises two white coils surrounding blue flower with yellow style resting on a column simulator with two branches, each branch holds a locust. Between every two segments there is a bull head with a specific flower between its horns. There are two bands with increasing width emerging from the adjacent point of every two coils and holding a grasshopper.

Inscription of the 19th Dynasty Tombs Ceiling

The 19th Dynasty was the second Dynasty of the New Kingdom, covered a time span from 1292 to 1189 BC and ruled by 8 Pharaohs.^[26] The 19th Dynasty tombs comprised distinguished examples of tomb-ceiling inscription for the purpose of tomb decoration. The idea of tomb-ceiling inscription during the 19th Dynasty is explored through nine examples as follows:

- The first example is a ceiling scene in the tomb of Userhat, Servant in the Temple of Thutmose I during the reign Ramses I and Seti I, 1st and 2nd Pharaohs of the 19th Dynasty, 1292-1279 BC shown in Fig.13.^[27] This is a novel pattern design comprising elements consisting of 11 white petals flowers with red and blue styles housed inside blue and red semi-rhombuses. The rest of the free spaces are filled with yellow-coils going around blue discs. A hieroglyphic text is painted inside a diagonal band with thick white boundaries.

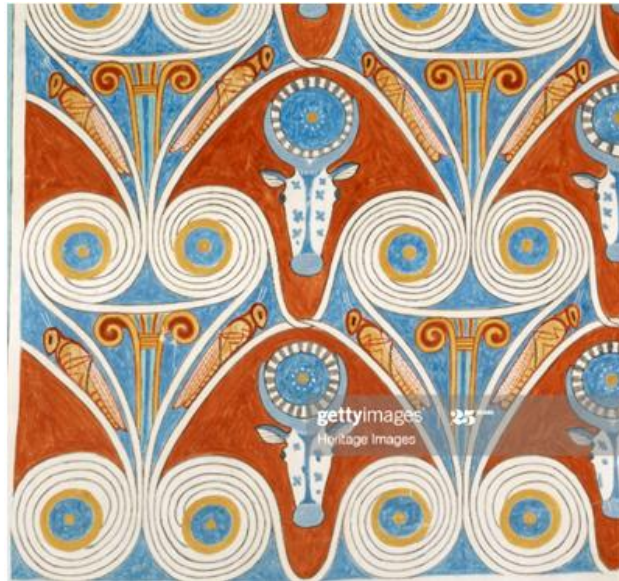


Fig. 12: Ceiling scan in the tomb of Neferhotep.^[25]



Flower simulator element



Fig. 13: Ceiling scan in the tomb of Userhat.^[27]

- The second example is a ceiling scene in the tomb of Seti I, 2nd Pharaoh of the 19th Dynasty, 1290-1279 BC shown in Fig.14.^[28] This is an astronomical ceiling comprising an astronomical table and a scene of some of the ancient Egyptian Deities. The list in the table provides names of stars in the 'Great Bear Constellation'.^[29]



Fig. 14: Ceiling scan in the tomb of Seti I.^[29]

- The third example is a ceiling scene in the tomb of Pashedu, Servant in the Place of Truth during the reign of Pharaoh Seti I and Early days of Ramses II, 2nd and 3rd Pharaohs of the 19th Dynasty, 1290-1270 BC shown in Fig.15^[30]. The decoration pattern of Pashedu's ceiling consists of a hieroglyphic text written in columns and rows bounded by red thin lines for rows and thick lines for columns.



Fig. 15: Ceiling scan in the tomb of Pashedu.^[30]

- The fourth example is a ceiling scene in the tomb of Sennedjem, Artisan during the reign of Pharaohs Seti I and Ramses II, 1290-1213 BC shown in Fig.16.^[31] The decoration of the ceiling is based on presenting the tomb owner worshipping alone in one view and

worshipping with his wife in the other image on the curved ceiling. Funerary text is written inside bounded bands using the hieroglyphic script.



Fig. 16: Ceiling scan in the tomb of Sennedjem.^[31]

- The fifth example is a ceiling scene in the tomb of Neferrenpet, Chief Scribe of the Treasury for the Temple of Amun-Ra during the reign of Pharaoh Ramses II, 1279-1213 BC shown in Fig.17.^[32] The decoration of the ceiling is based on units consisting of white coils around a grey core with the coil terminal going to another core. The coil terminals construct borders of rhombuses holding other concentric rhombuses with grey, blue and red colors. The rest of the areas comprised 4-petals flower simulators.



Fig.17: Ceiling scan in the tomb of Neferrenpet^[32]

- The sixth example is a ceiling scene in the tomb of Nefersekeru, Deputy Administrator of the Treasury and Scribe of Divine Offering during the reign of Pharaoh Ramses II, 1279-1213 BC shown in Fig.18.^[33] The decoration of the ceiling is based on black lines drawn in two directions to construct adjacent rhombuses of black borders holding other yellow

rhombuses with 4-petals flower simulators. The background of the flowers is white in one row and yellow in the next row. The petals are brown in one row and light green in the next row. The style is brown in the yellow background flowers and light green in the white background flowers. For anthers are common in all the flower simulators.



Fig.18: Ceiling scan in the tomb of Nefsekheru.^[33]

- The seventh example is a ceiling scene in the tomb of Queen Nefertari, Great royal Wife of Pharaoh Ramses II, 1279-1213 BC shown in Fig.19 ^[34]. The decoration of the ceiling is based entirely on using white stars on a dark blue background simulating the real sky. The ceiling is bordered by a white thick line below which come wonderful colored scenes on the walls for the Queen and some of the ancient Egyptian Deities and hieroglyphic text in columns and cartouche. The high quality reflects the sophistication of the art, mechanical and chemical technology in this era.



Fig.19: Ceiling scan in the tomb of Nefertari ^[34]

- The eighth example is a ceiling scene in the tomb of Seti II, 5th Pharaoh of the 19th Dynasty, 1203-1197 BC shown in Fig.20^[35]. The decoration of the ceiling consists of a duplication of Nekhbet spreading its wings to cover the whole width using brown and white colors.



Fig. 20: Ceiling scan in the tomb of Seti II.^[35]

- The ninth example is a ceiling scene in the tomb of Siptah, 7th Pharaoh of the 19th Dynasty, 1197-1191 BC shown in Fig.21.^[36] The decoration of the ceiling consists of a duplication of a scene for the Nekhbet Deity of the ancient Egyptians spreading its wings and wearing the Atef Crown. Hieroglyphic text is written in horizontal light-blue-un-bounded rows above each image of Nekhbet including two Cartouches of the Pharaoh one above each wing. The longitudinal borders of the ceiling are decorated by a hieroglyphic text written inside two bounded yellow-columns. White stars are drawn on a light-blue background under each scan of Nekhbet.



Fig.21: Ceiling scan in the tomb of Siptah^[36]

Inscription of the 20th Dynasty Tombs Ceiling

The 20th Dynasty was the third and last Dynasty of the New Kingdom, covered a time span from 1189 to 1077 BC and ruled by ten Pharaohs.^[37] The ceiling inscription during the 20th Dynasty is explored through presenting only four examples as follows:

- The first example is a colored scene decorating the ceiling of the tomb of Niay, Scribe during the 20th Dynasty, 1189-1077 BC shown in Fig.22.^[38] The decoration pattern of this part of the Owner's scene consists of two scenes separated by a hieroglyphic text written in a row bounded by two thick bands full of colored geometric shapes. The elements of the scenes are zoomed below the scenes of Fig.22. The elements in the figure right are composed of squares housing 4 petals flower simulators of red color on yellow background in one row and white background in the next row and so on. The elements in the left side of the figure comprises 4 petals flower simulator housed by a thick boundary circular band with white background in a row followed by yellow spirals around white objects in a row and so on. There is another hieroglyphic text separated from the ceiling scenes by a decoration band housing geometric shapes.



Fig. 22: Ceiling scan in the tomb of Niay.^[38]

- The second example is a colored scene in the ceiling of the tomb of Ramses IV, 3rd Pharaoh of the 20th Dynasty, 1155-1149 BC shown in Fig.22.^[39] The decoration pattern of the scene depends on the Nekhbet Deity drawn spreading its wings followed by a bounded row of a hieroglyphic text incorporating two Cartouches of the Pharaoh, then this scheme is repeated. The designer two blue lines frames around the decoration scheme of the ceiling.



Fig. 23: Ceiling scan in the tomb of Ramses IV.^[39]

- The third example is a colored scene in the ceiling of the tomb of Ramses VI, 5th Pharaoh of the 20th Dynasty, 1145-1137 BC shown in Fig.24^[40]. The decoration pattern of the scene is divided into two parts isolated by two yellow bands decorated by one row of stars and two rows of stars. The two parts of the pattern have dark blue background and scenes from the 'Book of the Day' and Book of the Night'.^[41]



Fig.24: Ceiling scan in the tomb of Ramses VI^[40]

- The fourth example is a colored scene in the ceiling of the tomb of Ramses IX, 9th Pharaoh of the 20th Dynasty, 1129-1111 BC shown in Fig.25.^[42] The decoration scheme is similar to that in the tomb of Pharaoh Ramses VI (Fig.42) except the background color and the drawing of Goddess Nut in the top view of the two parts of the pattern and using brown discs in the yellow bands instead of stars. The scenes are extracted from the 'Book of the Night'.^[42]



Fig. 25: Ceiling scan in the tomb of Ramses IX.^[42]

CONCLUSION

- This paper investigated the evolution of mechanical engineering in ancient Egypt through the study of tomb-ceiling inscription during the New Kingdom.
- Wonderful scenes on tom-ceilings were inscribed during the 18th and 19th Dynasties.
- The decoration of the ceilings of non-royal official tombs was based on patterns consisting of 4-petal flower simulators.
- The background of the flower simulators was colored in blue, white, yellow, brown and red.
- A ceiling decoration during the 18th Dynasty comprised a wood-pulp simulation cut longitudinally.
- Zigzag patterns were used for ceiling decoration during the 18th Dynasty.
- Coil patterns were used for ceiling decoration during the 18th and 19th Dynasties.
- Astronomical patterns were used for ceiling decoration during the 18th , 19th and 20th Dynasties.

- The first astronomical ceiling appeared in the tomb ceiling of Senenmut from the 18th Dynasty.
- Hieroglyphic text inscriptions were used in ceiling decoration during the 18th, 19th and 20th Dynasties.
- Nekhbet Deity was used as the main element in ceiling decoration during the 19th and 20th Dynasties.
- The ceiling of Royal tombs was decorated using patterns based mainly on white stars on blue background simulating the sky. This decoration technique was applied during the 18th and 19th Dynasties except during the 20th Dynasty where the stars were blue on yellow background.
- 32 % of the investigated ceiling decoration were Royal while 68 % of them were non-Royal.

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- Chief Justice of the International Journal of Computer Techniques and the Journal of Engineering Techniques.
- Member of the Editorial Board of a number of International Journals including WJERT.
- Reviewer in a number of international journals.